

Smith (A. H.)

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Tubes.

BY
ANDREW H. SMITH, M. D.

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THE PRINCIPLES INVOLVED IN THE CON- STRUCTION OF SPRAY-TUBES.*

BY ANDREW H. SMITH, M. D.

THE Bergsen, or, as it is more commonly called in this country, the Sass spray-tube, having practically superseded all other forms, it is to this that attention will be confined in this paper.

The instrument consists essentially of two tubes placed one above the other, the upper one, which for brevity's sake we will designate A, carrying compressed air or steam, while the lower one, which we will call F, supplies the fluid to be atomized.

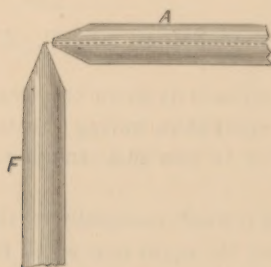
The free extremities of these tubes, greatly diminished in size, are so arranged in relation to each other that the stream of air issuing from A passes at a right angle across the tip of F. The action of the spray-tube depends upon the fact that air possesses a considerable degree of adhesiveness, the different particles adhering to each other with no little tenacity.

We are familiar with this property in viscid fluids and to a less degree in plain water, a drop of which can be drawn along a table by the finger, but we are not apt to

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think of it as belonging to the atmosphere or to gaseous bodies. Yet it is owing to the fact that the air or steam which escapes from A clings to and drags with it the air at the extremity of F that a vacuum is produced in F. Into this vacuum the fluid rises, and in its turn is caught by the current from A and dispersed in the form of spray.

The greater the velocity of the air-jet escaping from A, the greater will be the exhausting force exerted upon F, and therefore the greater the efficiency of the atomizer. As the velocity of the stream of air is greatest at its center,



where it is least retarded by friction, it follows that the axis of the opening of A should be exactly on a line with the extremity of F.

The pressure being the same, the character of the spray will depend upon the relative size of the openings of A and F. Increasing the former permits more air to escape and gives a larger volume of spray with a greater carrying force and more power of penetration. Increasing the latter results in a larger consumption of fluid, forming a coarser spray, and, if carried too far, results in dripping.

A large opening for A with a small one for F gives a large body of very fine spray. A small opening for A with a large one for F gives a small body of coarse spray. A successful application of spray to the throat or to the pos-

terior nares often requires that it be effected as it were by surprise, and before there is time for reflex action of the muscles. Hence it is necessary that spray should be formed the instant the air-valve is opened; for, if the arrival of the liquid at the point of F is delayed appreciably after air begins to issue from A, reflex contraction will have been excited by the contact of the air with the mucous surface before any spray is produced. Now, no fluid will reach the point of F until all the air in F is exhausted, and the amount of air and the length of time required for its exhaustion will be in proportion to the length and the caliber of the tube. Hence these should be reduced to a minimum in spray-tubes intended for making quick applications. And, as there is nothing lost in any case by this construction, it may as well be made the general rule for all tubes.

With a properly constructed spray-tube comparatively slight air-pressure will suffice for all purposes. Increase of pressure will compensate in a measure for defective construction of tubes, but it brings with it its own inconveniences, such as mechanical irritation of the surface to which the spray is applied, waste of compressing power, etc.

The indications for the use of coarse or fine spray do not come within the scope of this paper, and will vary in accordance with the views of individual practitioners.

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